

captain, and obtained a commission in the Grenadier Guards. But the ordinary guardsman's life in times of peace was inadequate to his aspirations, and reaching the rank of captain, he was soon after appointed aide-de-camp to Sir Henry (afterwards Lord) Hardinge, then Governor-General of India, and in that capacity accompanied his chief through the ever-memorable campaign of the Sutlej. After the English arms had triumphed in the conquest of the Punjab, Lord Arthur was attached to a mission, the details of which, we believe, have never been made public, to some of the tribes bordering upon our northern frontier, and in discharge of that duty reached places unvisited by any European traveller since the days of Moorcroft. Lord Arthur's services in India and the adjacent countries lasted over several years, in the course of which time his attention was attracted by their rich and little-known fauna, and he not only formed the acquaintance, but assiduously cultivated the friendship of two of the greatest Indian zoologists of the time—Jerdon and Blyth—of whom he became an apt pupil, fishes and birds being particularly the objects of his pursuit. Returning home at length he resumed his regimental duties, and on the outbreak of the Russian war, in 1854, he accompanied the expeditionary force first to Turkey and thence to the Crimea, taking part in the operations which ended in the fall of Sebastopol. Soon after the conclusion of peace he left the army, and his old zoological tastes, which had been growing slack, returned to him more strongly than ever. On the death of his eldest brother, Lord Gifford, he became heir to his father's honours and estates, and assumed the courtesy title of Lord Walden, by which, perhaps, he will be most generally recognised, for under that designation he published the greater part of his contributions to zoology, and under it he succeeded the late Sir George Clerk as President of the Zoological Society, performing the duties of that office with a singular amount of dignity and urbanity. For several years he continued to live in a cottage he had built for himself at Chislehurst, and there he began to form an ornithological library and collection on a scale almost unattempted hitherto in this country, though the collection was supposed to be limited to Indian, or at least Asiatic, specimens. On the death of his father, at a very advanced age, in 1876, Lord Walden inherited the Scottish peerage and estates, and thenceforth his home was mainly the old ancestral seat of Yester, near Haddington, where he entered, with the energy natural to his character, upon the life of an agriculturist; in this respect following the example of his father, who had long since turned his sword into a ploughshare, and had earned the reputation of being one of the most scientific farmers in that part of North Britain, which is the headquarters of scientific farming.

The late Lord Tweeddale was a frequent and, when occasion required, a powerful writer. Most of his acknowledged communications are to be found in the *Journal of the Asiatic Society of Bengal*, the *Ibis*, and the *Proceedings and Transactions of the Zoological Society*, but it is believed that his anonymous contributions to the public press were still more numerous, though these were seldom on scientific topics. He married twice: first, the daughter of the late Count Kielmansegge, for many years the popular Minister of Hanover at this Court, who died in 1871, and secondly, a daughter of Mr. Mackenzie of Seaforth, who survives him.

One word must be said of Lord Tweeddale's generosity. No reasonable project for the advancement of zoology in any of its branches was ever started but he was ready to support it liberally. His loss will be deeply felt by a wide circle of his brother ornithologists, and the Zoological Society will find it very difficult to replace him in its presidency, a post which seems to require a peculiar position of scientific and social rank.

NOTES

WE are happy to state that at the end of the last legislative session the French Central Bureau of Meteorology obtained from the National Exchequer a sum of 120,000 francs, required for the organisation of the services which were decreed in the month of June. A semi-monthly paper will be issued by the Bureau summarising the results of observations during that period. The work of normal schools, which had been suspended during two or three years, will be resumed and published as in former times.

THE French Minister of Public Works has prepared a most important decree, which was signed on December 20 last. For the execution of the great works which have been voted by the French Parliament, an auxiliary corps of Ponts-et-Chaussées engineers has been created. The members of this newly created body will enjoy the same privileges as the government engineers who have been trained at the Polytechnic School. The consequence is that the privileges of that celebrated establishment are practically at an end, and the principle that office should be given to the fittest irrespective of their origin has a fair chance of becoming an axiom of the French administration.

THE first part of a posthumous work by Prof. Poggendorf on the History of Physics has been sent us by Messrs. Williams and Norgate. It will be completed in three parts and will contain much interesting matter collected by the late eminent physicist during his long career as lecturer at the Berlin University. We have also received the first part of the "Publications of the Astrophysical Observatory of Potsdam," containing observations of sun-spots from October, 1871, to December, 1873, by Dr. Spörer.

FROM *Science News* we learn that Mr. Alex. Agassiz left Cambridge (U.S.) on December 1 for a second dredging-trip in the West Indies on the Coast Survey steamer *Blake*. The specimens secured by him are divided among scientific men in Europe and America, who work them up, while many of them go into his own Cambridge collection. This year he will cruise between the Windward Islands and the coast of South America, having spent last winter in the Gulf of Mexico.

THE prominence given to science is a noteworthy feature in the annual summaries for the past year which appear in most of our newspapers.

WE have much pleasure in drawing our readers' attention to the following circular concerning a Society for the Collection of South African Folk Lore. The circular explains itself, and we trust that those of our readers who are interested in the subject will subscribe to the periodical which it is desired to start:— "The existence, among the aboriginal nations of South Africa, of a very extensive traditional literature, is a well-known fact. Not a few stories forming part of this literature have been written down; and as in some of them terms occur which no longer appear to be used in colloquial language, and the meanings of which are, in many instances, not fully understood, there is no doubt that we meet in them with literary productions of great antiquity, handed down to the present generation in a somewhat similar manner to that in which the Homeric poems reached the age of Pisistratus. But European civilisation is gaining ground among the natives, and within a few years the opportunities for collecting South African folk-lore will be, if not altogether lost, at least far less frequent than they are now. This would be a great loss to 'the science of man,' particularly as there is much which is exceptionally primitive in the languages and ideas of the South African aboriginal races. There are not a few missionaries and other Europeans in South Africa who have ample opportunities for collecting South African folk-lore. Some of

these, however, are not aware of the importance of such collections, and those who are would be greatly encouraged in the task of making them, if a channel for their speedy publication existed. In the hope of contributing towards the collection of South African traditional literature, a Folk-Lore Society is in course of formation at Cape Town, which already includes members in distant parts of South Africa. The publication of a small periodical every second month is also proposed by the Society. The annual subscription to this periodical will be four shillings, exclusive of postage. Folk-lore intended for publication in it should be accurately written down in the language and words of the narrator, and a translation into English, or some other well-known European language, added. Further information regarding facts illustrative of native life or native literature will also, whenever practicable, be published. Intending subscribers to the projected periodical are requested kindly to send in their names and addresses, stating the number of copies required by them, to the secretary of the South African Folk-Lore Society, care of Miss L. C. Lloyd, Cape Town."

ACCORDING to a report made by Prof. Palmieri an interesting application of the microphone to volcanic phenomena has just been made by Prof. Michele Stefano de Rossi, who during a series of experiments extending over several months and made at his seismic observatory at Rocca di Papa in the Albanese Mountains, has found that the present eruption activity of Mount Vesuvius could be perceived through the microphone even at that enormous distance. Prof. de Rossi, in order to continue his experiments, has recently stayed with Prof. Palmieri at the Vesuvius Observatory, and they have together visited the crater of the Solfatara near Pozzuoli, where the subterraneous work of the volcanic forces became so very evident to the sense of hearing, that a considerable amount of fear was caused amongst those present at the experiments. Prof. de Rossi will publish an account of his researches in his serial *Il Vulcanismo*.

EARTHQUAKES are reported from Seefeld (Tyrol) on December 14 at night, where the shock came in the direction from north to south, and from Luxemburg on December 15 at 11 A.M. where six or seven distinct oscillations were noticed.

NEWS from the American Republic of San Salvador states that the volcanoes of Santa Ana and of Izalco are in eruption. The eruption of the former had been anticipated for some time past (see NATURE, vol. xix. p. 86), and seems to be of particular violence.

"AN English Manufacturer" makes a strong appeal in yesterday's *Times* on behalf of the introduction into this country of the decimal system in weights, measures, and coinage. It is long since we showed the absurdity of our present systems, and the necessity for the introduction of something more scientific. But the "Manufacturer" shows that by our want of any international system, such as prevails among other nations, the trade of this country seriously suffers. We hope this aspect of the question will be urged upon the Government by all interested, and that a much more radical reform will be instituted than what has been attempted in the recent most unsatisfactory Weights and Measures Act.

THE director of the Vienna Geological Institution, Counsellor Franz von Hauer, has been nominated "Officier de l'Instruction publique" by the French Minister of Public Instruction.

M. W. DE FONVIELLE sends us the following details concerning the recent electrical observations at Montsouris Observatory:—Electrical observations are registered regularly at Montsouris seven times a day, according to a proper scale of variations, and with a Thomson electrometer. These observations are made by M. Descroix, under the general direction of

M. Marie Davy, the director of the observatory, and the results are recorded daily in the *Paris Temps*. The series from the beginning of the month of December offers some notable peculiarities. The frost in Paris set in on December 7, and from that date to the 22nd there were fifteen days of continued cold. Only once, on the 18th, a thaw was for a few hours imminent, but the snow was not melted in the observatory grounds. During the whole of that period not less than 105 careful readings were taken and registered, but not a single one of these readings exhibited the least negative tendency. The variations were very few, and the sign + was always recorded. This high positive state of tension was observed in spite of a number of variations in the pressure of the air, which was almost always under 760 mm., and sometimes so low that the forecast published by the Bureau Central announced "approaching rainfall." The maximum was on the 19th, during a heavy cold fog; it was so large that the instrument was thrust out of balance, and the record of the number is wanting. The tension then exceeded 200 Daniell cells. From that time the scale of comparison was altered, so that the range of the instrument was enlarged. In consequence of this observation it was suggested that the real thaw, or change of weather would not set in without the previous appearance of negative tension. Instructions were given by M. Marie Davy to test this suggestion by a careful examination of the electrical circumstances attending this lengthened period of unprecedented cold and the future thaw which would put an end to it. The thaw set in in France on the night of December 25-26, at an hour varying according to the circumstances of the several localities. The electrical readings at Montsouris were found positive on the 25th during the whole of the day, but the mean value was greatly diminished, and the readings very unequal. On December 26 at six in the morning, negative readings were taken and registered for the first time since December 7. It must be added that under the circumstances the Thomson electrometer kept at Montsouris is not considered by M. Descroix as exhibiting the exact numerical value of the tension of the air, but merely its kind and the general progress of the phenomenon. This reservation has been made in a correspondence with Signor Palmieri, the director of the Mount Vesuvius Observatory, on the occasion of some strictures passed on the location of the Thomson electrometer used in these observations.

No general meeting of the Association for the Improvement of Geometrical Teaching will be held in January, 1879. Considerable progress has been made by the sub-committees appointed in January, 1878, and draft syllabuses will soon be submitted to members of the Association.

M. VALENTIN has been snowed up during more than fourteen days in the observatory on the top of the Puy-de-Dome, where he takes the meteorological readings. The telegraph connecting Puy-de-Dome with Clermont laboratories being out of order no telegram has been received from him for a lengthened period. No anxiety is felt for his safety, he having been well furnished with provisions and fuel. A similar accident has befallen General de Nansouty, the director of the Pic du Midi Observatory. His telegraphist having descended to Bagneres was unable to ascend again and the General was left to his fate. As he is rather old and of delicate health heroic efforts were made by the peasantry to reach him, which they did on December 24; the telegraphic line was repaired and telegrams recorded as usual in the *Bulletin International*. General de Nansouty refused to relinquish his post, and he is spending his winter as usual on one of the highest peaks of France.

THE *Neue Wiener Zeitung* states that an electric light has been tried on a locomotive on the Vienna Railway system. The

apparatus was designed by Mr. Whitehead, the inventor of the celebrated torpedo, and is said to have worked satisfactorily.

A CORRESPONDENT writes to us that in looking through some of the drawings and prints, &c., of Old London, belonging to Mr. J. E. Gardner, F.S.A., of Park House, he came upon the following interesting handbill:—

London, 1775

Proposals
for a
Short course of lectures
on
Fossils
by
Emanuel Mendes da Costa.

The course will consist of only
TWELVE LECTURES.

A public Introductory lecture will be given gratis to
any one who chuse to come.

To begin on Wednesday, 7 June, at noon, at the Author's
apartments at a shoemaker's opposite Arundel Street in the Strand
and the future Lecture Hours will be determined by the sub-
scribers.

The conditions are

One Guinea the course.

To be paid on Subscribing.

Single lectures at two shillings and sixpence each.

Subscriptions are taken in at Mr. Elmsley's, Bookseller,
opposite Southampton St., Strand; Mr. White, bookseller in
Fleet-street; Mr. Humphreys, dealer in shells and other
curiosities in St. Martin's Lane, near Charing Cross; and by the
author at his said apartments.

N.B.—The Introductory lecture will be repeated on
Thursday evening at six o'clock.

It is proposed to hold an anthropological exhibition at Moscow
in the coming summer, together with a general meeting of
anthropologists from all parts of the world.

WE have on our table the following works:—"History of
the Steam Engine," R. H. Thurston, Kegan Paul and Co.;
"Études et Lectures sur l'Astronomie," Camille Flammarion,
G. Villars, Paris; "Catalogue des Étoiles Doubles et Multiples,"
Camille Flammarion, G. Villars, Paris; "Sport and Work on
the Nepaul Frontier," "Maori," Macmillan and Co.; "Mathe-
matical Problems," J. Wolstenholme, Macmillan and Co.;
"The Fairy-Land of Science," Arabella B. Buckley, E.
Stanford; "Das Leben," Philipp Spiller, Gerstmann, Berlin;
"Wanderings in Patagonia," Julius Beerbohm, Chatto and
Windus; "Natural History of Victoria," Frederick McCoy,
Trübner; "Fourth Annual Report of the Imperial Mint;"
"Extra Physics and the Mystery of Creation," Hodder and
Stoughton; "From Kulja Across the Tian Shan to Lob Nor,"
Col. N. Prejevalsky, Sampson Low and Co.; "The Heart
of Africa," Dr. Georg Schweinfurth, Sampson Low and
Co.; "The Philosophy of Science, Experience, and Reve-
lation," John Coutts, F. Pitman; "The Native Flowers and
Ferns of the United States," Parts 13, 14, 15, 16, Thomas
Mechan, L. Prangola, Boston; "The Principles of Light
and Colour," Edwin B. Babbitt, Trübner and Co.

THE additions to the Zoological Society's Gardens during the
past week include a White-whiskered Paradoxure (*Paradoxurus*
leucomystax) from East India, presented by Mr. W. G. Wilson;
a Common Barn Owl (*Strix flammea*), British, presented by
Mr. W. Davies; a Common Coot (*Fulica atra*), British, pre-
sented by Mr. F. H. O'Donoghue; two Philantomba Antelopes
(*Cephalophorus maxwelli*) from West Africa, two Egyptian Jerboas
(*Dipus aegyptius*) from Egypt, purchased; three River Jack
Vipers (*Vipera rhinoceros*) from West Africa, deposited.

CIRCULATING DECIMALS

THE properties of circulating decimals mentioned by Mr. R. Chartres and by Mr. E. P. Toy in NATURE (vol. xviii. pp. 291, 541) are particular cases of very general laws relating to the periods of circulating decimals of which, as they are not stated with any approach to completeness in any work on arithmetic with which I am acquainted, it may be worth while to give a brief explanation.

Consider the process of converting a vulgar fraction into a circulating decimal; take for example $\frac{1}{39}$. The work is—

$$\begin{array}{r} 39) 1.00 (\overset{\circ}{0}2564\overset{\circ}{1} \\ \underline{78} \\ 220 \\ \underline{195} \\ 250 \\ \underline{234} \\ 160 \\ \underline{156} \\ 40 \\ \underline{39} \\ 10 \end{array}$$

which may be more concisely and better arranged thus:—

$$\begin{array}{r} 39) 1 (\overset{\circ}{0} \\ 10 \quad 2 \\ 22 \quad 5 \\ 25 \quad 6 \\ 16 \quad 4 \\ 4 \quad 1 \end{array}$$

10, 22, 25, 16, 4 being the remainders and the corresponding
quotient figures being written at the side. From this it is clear
that—

$$\begin{array}{l} \frac{1}{39} = .025641, \frac{10}{39} = .256410, \frac{22}{39} = .564102, \frac{25}{39} = .641025, \\ \frac{10}{39} = .410256, \frac{22}{39} = .102564, \end{array}$$

and the numbers 1, 10, 22, 25, 16, 4 form a cycle such that if
we divide any one of them by 39 we obtain the others as re-
mainders in this order, and all the fractions give rise to the same
period, though the beginning is made in each case at a different
place in the period.

The following are three other divisions arranged in the same
manner:—

$$\begin{array}{r} 39) 2 (\overset{\circ}{0} \\ 20 \quad 5 \\ 5 \quad 1 \\ 11 \quad 2 \\ 32 \quad 8 \\ 8 \quad 2 \end{array} \quad \begin{array}{r} 39) 38 (\overset{\circ}{9} \\ 29 \quad 7 \\ 17 \quad 4 \\ 14 \quad 3 \\ 23 \quad 5 \\ 35 \quad 8 \end{array} \quad \begin{array}{r} 39) 37 (\overset{\circ}{9} \\ 19 \quad 4 \\ 34 \quad 8 \\ 28 \quad 7 \\ 7 \quad 1 \\ 31 \quad 7 \end{array}$$

The four divisions thus give the values of the periods of the
fractions $\frac{1}{39}$, $\frac{2}{39}$, $\frac{3}{39}$, $\frac{4}{39}$, . . . $\frac{35}{39}$, i.e., of all the proper fractions
in their lowest terms, having 39 as denominator. In this case,
there are four distinct periods, or, say, four periods
each containing six figures; one of these, viz., that to which $\frac{1}{39}$
belongs, may be called the leading period.

In general if q be any number prime to 10, and if all the
proper fractions in their lowest terms having q for denominator
be converted into decimals there will be f periods each contain-
 a digits, and a and f will be connected by the relation $af = \phi(q)$,
where $\phi(q)$ denotes the number of numbers less than q and prime
to it. If q be a prime, $\phi(q) = q - 1$.

It is to be observed that if we divide r and $q - r$ respectively
by q the digits of the periods will in the two cases be comple-
mentary, i.e., the sum of each corresponding pair will be 9. Thus
in the case of 39

$$\begin{array}{l} \frac{1}{39} = .025641 \quad \frac{1}{39} = .051282 \\ \frac{2}{39} = .102564 \quad \frac{2}{39} = .194871 \end{array}$$

and $9 + 0 = 9$, $7 + 2 = 9$, &c. Also, the sum of each pair of
corresponding remainders is q ; e.g., in the divisions for $\frac{1}{39}$ and
 $\frac{2}{39}$, $\frac{3}{39}$ and $\frac{4}{39}$, the sum of each pair of corresponding remainders
is 39.

If, as in the case of 39, the remainder $q - 1$ does not belong
to the leading period, the periods may be arranged in pairs, the
periods in each pair being complementary to one another. If